

The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Integrating Dynamic Pricing with Inventory Decisions under Lost Sales[#]

by

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The Hong Kong Polytechnic University

(Conducted in English)

Abstract:

Inventory-based pricing under lost sales is an important, yet notoriously challenging problem in the operations management literature. Since the first attempt to solve this problem in the mid-fifties, the existing analyses are still limited to either single-period or long-term stationary models with restrictive assumptions on the price-demand relationship. We start with summarizing the latest developments on the single-period problem, pointing out the limitations and proposing an alternative approach to tackling this problem. In particular, we show that, under very general conditions on the demand function, the objective function is concave along the optimal price path provided that the price is decreasing in the post-order inventory level. The concavity of the single-period problem, however, does not imply the concavity of the multi-period problem. Using properties of stochastic functions, we derive a set of general conditions on the demand function under which the dynamic problem is concave along the optimal price path whenever the optimal price is decreasing in the inventory level. These conditions are general enough to cover both (stochastically) concave and convex demand functions. A decreasing price path, though not always optimal, is practically appealing and intuitive to implement. In the case when the optimal price is not monotone in the post-order inventory level, we identify a bounded set of candidate decreasing price paths, along which the objective function is concave. Any decreasing price path outside of this set would lead to a lower expected profit than some path within the set. Our extensive numerical testing suggests that the restriction of decreasing price path does not lead to a significant optimality gap---The optimal price path is indeed decreasing in most instances and, even when it is not, the profit loss is very marginal.

#this is a joint work with Qi Annabelle Feng and Sirong Luo.

Bio:

J. George Shanthikumar is the Richard E. Dauch Chair Professor of Manufacturing and Operations Management, a University Distinguished Professor of Management and Co-Academic Director of the MS program in Global Supply Chain Management at the Krannert School of Management, Purdue University, West Lafayette, IN. Before joining Purdue, he was a Chancellor's Professor of Industrial Engineering and Operations Research at the University of California, Berkeley, CA. He received the B. Sc. degree in mechanical engineering from the University of Sri Lanka, Peradeniya, and the M. A. Sc. and Ph. D. degrees in industrial engineering from the University of Toronto, Toronto, Canada. His research interests are in model uncertainty & learning, production systems modeling and analysis, queueing theory, reliability, scheduling, semiconductor yield management, simulation, stochastic processes, and supply chain management. He has written or written jointly over 300 papers on these topics. He is a coauthor (with John A. Buzacott) of the book *Stochastic Models of Manufacturing Systems* and a coauthor (with Moshe Shaked) of the book *Stochastic Orders and Their Applications* and the book *Stochastic Orders*. He is a Fellow of the Institute for Operations Research and Management Science (INFORMS) and Production and Operations Management (POM) Societies.

He is a member of the editorial advisory boards of *Asia-Pacific Journal of Operations Research* and *IEEE Transactions on Automation Sciences and Engineering*, and an area editor for *Journal of the Production and Operations Management Society*. He was a member of the editorial advisory board of *Journal of the Production and Operations Management Society*, was a co-editor of *Flexible Services & Manufacturing Journal*, area editor for *Operations Research Letters* and was an associate editor for *IIE Transactions*, *International Journal of Flexible Manufacturing Systems*, *Journal of Discrete Event Dynamic Systems*, *Operations Research*, *OPSEARCH*, *Probability in the Engineering and Informational Sciences* and *Queueing Systems: Theory and Applications*.

Dr. Shanthikumar has extensively consulted for various companies like Applied Materials (AMAT), Bellcore, IBM, KLA-Tencor, NTT (Japan), Intel, Intermolecular, Reel Solar, Safeway, and Southern Pacific Railways and through KLA-Tencor worked on Joint Development Projects for AMD, IBM, Intel, LSI, Motorola, TI, Toshiba, Fujitsu, TSMC and UMC. He is an advisory consultant for Sensor Analytics and a member of the technical advisory board of Inter Molecular Inc. and Reel Solar, Inc.

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All are welcome!